SCIENTIST IN RESIDENCE PROGRAM™

Science Unit: ***Marine Communities & Fisheries***

Lesson #1: ***Ocean Zones Internet Research***

Lesson Summary:
In this lesson, students do internet basic ocean facts, including measures of the vastness of the ocean and the unique chemical and physical features of ocean water. They will also explore different ocean zones related to depth and sunlight penetration, discover organisms that live in those zones and discuss how human beings interact with these zones.

Grade level:	Presented to grade 4/5 and 5; appropriate for grades 3 – 7 with age appropriate modifications
Duration of lesson:	1 hour and 15 minutes
School Year:	2015/2016
Developed for:	George M. Weir Elementary School, Vancouver School District
Developed by:	Jean Marcus (scientist) for Amber Burma and Angelina Yu (teachers)
Notes:	This lesson is intended to provide students with a general introduction to the ocean so that subsequent lessons focusing on fisheries will have a geographical/physical context.

Learning Objectives

1. Learn that the ocean can be conceptually divided into different zones, based on depth and penetration of sunlight.
2. Discover three major ocean ecosystem zones: intertidal, neritic and oceanic.
3. Imagine and research which organisms live in different ocean zones and how people interact with these different ocean zones.

Materials

Pencil

Computer or tablet (with internet access)

Activity sheet 1Activity sheet 2

Background Information

The ocean covers over 70% of the planet and holds 99% of the world's inhabitable space. Our planet should perhaps be called "Ocean" rather than "Earth"! The ocean contains 97% of Earth's water, and oceanographers have stated that less than 5% of the World Ocean has been explored. The total volume is approximately 1.35 billion cubic kilometers with an average depth of nearly 3,700 meters.

Scientists estimate that almost 9 million species live on our planet, of which about 1.5 million identified have been identified. Currently about 230,000 species are known to live in ocean habitats, but since much of the oceans depths remain unexplored, over two million marine species are estimated to exist. About 86% of land and 91% of marine species are thought to be still undiscovered.

This lesson introduces students to three major ecosystem zones in the ocean – the Intertidal Zone, the Neritic Zone and the Oceanic Zone. These zones are themselves characterized by water depth and penetration of sunlight into the water. The Intertidal Zone is the coastline or shoreline between high and low tides. This area is always exposed to sunlight. The Neritic Zone is the shallow part of the ocean below mean low water to 200 m depth and typically lies above the continental shelf. Neritic waters are penetrated by sunlight, which permits photosynthesis by both planktonic and bottom-dwelling organisms. The zone is characterized by relatively abundant nutrients and biological activity because of its proximity to land. The Oceanic Zone is the area off shore where the water depth is 200 meters or deeper. It is the area of open water beyond the edge of the continental shelf and includes about 65% of the ocean's open water. The oceanic zone has a wide array of undersea terrain, including trenches, deep-sea volcanoes and ocean basins. In these three zones, organisms live on the seafloor (benthic), in the water (pelagic), where there is light (photic zone), or where there is little or no light (aphotic zone).

This lesson challenges students to think about which organisms live in the different ocean zones, and how human beings interact with these different zones. Teachers are encouraged to find examples of intertidal, neritic and oceanic ecosystems that fit their local context.

Vocabulary

Word:	Brief definition
Ocean	The entire body of salt water that covers >70% of the Earth's surface
Marine	Relating to the ocean (e.g. a marine animal is an animal that lives in the ocean)
Salinity	The amount of salt in water
Depth	The distance of a place beneath the ocean to the surface of the ocean
Temperature	The degree of hotness or coldness (of a place, person)
Coastline/Shoreline	The land along the edge of the ocean
Continental Shelf	The continental shelf is an underwater landmass that extends into the ocean from shore, until a drop off point called the shelf break, where the continental slope starts. Even though they are underwater, continental shelves are part of the continent. The width of continental shelves vary; off California it is less than one km in places, while off of Siberia (northern edge) is extends 800km. They are typically gently sloping plains covered with shallow water (<200m).
Continental margin	Area between the continental shelf and the abyssal plain, comprises a steep continental slope followed by the flatter continental rise.
Abyssal plain/Deep sea	An abyssal plain is an underwater plain on the deep ocean floor, usually found at depths between 3000 and 6000 m. They lie between the foot of a continental rise and a mid-ocean ridge and cover more than 50% of the Earth's surface. They are among the flattest, smoothest and least explored regions on Earth.

Lesson Detail

Introduction

a. Start with a slide presentation highlighting general ocean facts, while eliciting and asking students questions throughout.

b. Below is a proposed flow for covering all the needed information, and each bullet can be a slide (or series of slides):
   - What is the ocean?
   - How deep is the ocean?
   - How many species live in the ocean?
   - Ocean: Geography & Ecosystem Zones (note: use local examples):
     - Coastline/Shoreline & Intertidal Zone
     - Continental Shelf & Neritic Zone
     - Ocean floor beyond the continental shelf (i.e. Abyssal Plain) & Oceanic Zone
   - Ocean Ecosystems Zones (Review slide)

Purpose of Activity:
Ask students to predict and research which local organisms live in the different zones of the ocean, and how people interact with the ocean environment in these different zones. If commercial fishing is not identified as a major human activity in the ocean, the teacher can highlight this in the concluding discussion.

Methods and Instructions:

1. Students complete Activity Sheet independently via research on the internet. Students can discuss their answers in small groups. Key words to help students search: intertidal organisms/animals/plants; neritic organisms, coastal fish, inshore fish; oceanic organisms, offshore fish, open ocean fish.

References

1. < http://biodiversity-corner.blogspot.ca/2010/04/marine-ecosystems-or-aquatic-diversity.html> Marine Ecosystems or Aquatic Diversity basics. [Cross-section of the ocean highlighting major zones]. Accessed May 2016.
2. <http://marinebio.org/oceans/open-ocean/> The Open Ocean. MarineBio: Sharing the Wonders of the Ocean to inspire conservation, education, research and a sea ethic. Accessed May, 2016.
3. http://ibis.geog.ubc.ca/biodiversity/efauna/ E-Fauna BC. Electronic Atlas of the Wildlife of British Columbia. [Students can use this to find local BC examples for Activity Sheet #2]
4. Peden, A. 2002. Marine Fishes of British Columbia. <http://ibis.geog.ubc.ca/biodiversity/efauna/documents/MarineFishofBC.pdf>

Extension Ideas (can be added in subsequent years)
Class creates a mural of a cross-section of the ocean. Can use mural as a backdrop and label different things depending on foci of lessons: ocean ecosystems/zones, organisms, local examples of how humans interact with the ocean in different zones etc.

	Intertidal Zone	Neritic Zone	Oceanic Zone
Who lives here? Find 2 or more examples (note if they are pelagic or benthic). Note: fish that live near or on the bottom are called demersal fish			
How do people interact with these zones? List 2 or more ideas			